(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 151 936 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
07.11.2001 Bulletin 2001/45

(51) Int Cl.[7]: **B65D 81/20**

(21) Application number: **00310163.1**

(22) Date of filing: **15.11.2000**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **04.05.2000 US 543439**

(71) Applicant: **Sonoco Development, Inc.**
Hartsville, South Carolina 29550 (US)

(72) Inventors:
- **Gentile, Mike**
  Hartsville, South Carolina 29550 (US)
- **Sins, Veronique**
  1170 Brussels (BE)
- **Morrow, J Mark**
  Camden, South Carolina 29020 (US)
- **Lowry, James W.**
  Florence, South Carolina 29501 (US)
- **Clougherty, Kenan**
  Hartsville, South Carolina 29550 (US)

(74) Representative:
MacDougall, Donald Carmichael et al
Cruikshank & Fairweather
19 Royal Exchange Square
Glasgow G1 3AE, Scotland (GB)

(54) Container for fragile products and method of making such a container

(57) A tubular container for fragile products is provided according to the present invention that includes a flexible end closure that moves inwardly against the products when vacuum is applied during packaging for providing cushioning support to the products. The flexible end closure is secured to an end of a tubular body wall having opposed ends and inner and outer surfaces and comprises a wound strip of material. A flexible liner having opposed end portions is secured to respective ends of the tubular body by way of an adhesive band between the liner and the inner surface of the tubular body wall. The flexible liner thus has a free medial portion between the end portions which moves inwardly against the products when vacuum is applied. A vent hole may be formed through the body ply and an outer label by way of a laser for allowing the passage of air therethrough.

EP 1 151 936 A2

Printed by Jouve, 75001 PARIS (FR)

Description

FIELD OF THE INVENTION

[0001] The present invention relates to composite containers, and in particular relates to composite containers for vacuum packaging fragile products, such as potato crisps or cookie biscuits, and associated methods.

BACKGROUND OF THE INVENTION

[0002] Food and drink products and other perishable items are often packaged in tubular containers that are sealed at both ends. For some time, it has been recognized that substantial economies, as well as environmental advantages, can be effected by the use of composite containers, as opposed to the traditional glass and metal containers. These composite containers typically include at least one structural body ply made of paperboard and are formed by wrapping a continuous strip of the body ply material around a mandrel of a desired shape to create a tubular structure. The body ply strip may be spirally wound around the mandrel or passed through a series of forming elements so as to be wrapped in a convolute shape around the mandrel. At the downstream end of the mandrel, the tube is cut into discrete lengths and fitted with end caps to form the container.

[0003] Tubular containers of this type typically include a liner ply on the inner surface of the paperboard body ply. The liner ply prevents liquids from leaking out of the container and also prevents liquids from entering the container and possibly contaminating the food product contained therein. Preferably, the liner ply is also resistant to the passage of gases so as to prevent odors of the food product in the container from escaping and to prevent atmospheric air from entering the container through the liner and spoiling the food product. The liner ply is often a laminate including kraft paper, aluminum foil and/or one or more polymer layers. Thus, the liner ply provides barrier properties and the body ply provides structural properties for the composite container.

[0004] In addition, a label ply is typically included and adhered to the outer surface of the paperboard body ply. The label ply, which is typically a paper based ply, is a source of information. The label carries the graphical matter that conveys product information, instructions, and regulatory compliance information. The label is also preferably decorative and aesthetically pleasing to the consumer, which enhances shelf appeal and increases consumer interest in the food product.

[0005] Certain food products benefit from being packaged while under a vacuum. Vacuum packaging removes oxygen from the space surrounding the product, which can improve the shelf life of the product within the package. This is especially true for perishable food products, or food products that may become stale if exposed to air. However, it is generally recognized that vacuum packaging in some tubular containers can only be accomplished with difficulty, if at all. Because of the structural design of the composite container, the application of vacuum to the interior of the container often results in partial or complete inward collapsing of the container walls along the length of the container. This can result in an unacceptable appearance for the composite container or an unacceptable sealing of the product within the container.

[0006] This problem is further discussed in U.S. Patent No. 4,158,425, assigned to the assignee of the present invention and herein incorporated by reference. To avoid the partial or complete collapsing of the paperboard body ply of the container upon application of a vacuum inside the container, the container according to the '425 patent has an impermeable or hermetically sealed liner secured interiorly to the container body solely at the opposed ends thereof with the major length of the liner being free of the tubular body so as to allow an inward contracting of the liner without the introduction of excessive stresses to the container body itself. A vacuum or reduced pressure atmosphere within the liner causes an inward deformation of the liner into contact with the product substantially independently of the surrounding container body. Thus, the stresses which are transferred to the container body are at the opposed ends thereof which are in turn rigidified by a pair of conventional end caps.

[0007] The '425 patent, however, only addresses the problem of collapsing of the container walls. The '425 patent does not discuss or provide a container designed to secure the food products during transportation. In particular, fragile food products, such as potato crisp or cookie biscuits, are extremely susceptible to breakage during transportation. These types of products are typically stacked within the container such that the products can move about the container during transportation. Although the '425 patent provides an inwardly moving liner, it is directed to sealing the product for freshness without damaging the tubular body, and not directed to providing cushioning support to the food products in order to prevent damage during transportation.

[0008] Accordingly, there is a great need in the industry for a container that hermetically seals perishable food products, but that is also capable of protecting fragile food products during transportation. At the same time, however, such a container would also be capable of withstanding the rigors of vacuum packaging so as to increase the shelf life of the product and provide other benefits attendant to vacuum packaging.

SUMMARY OF THE INVENTION

[0009] These and other needs are provided, according to the present invention, by a tubular container having a flexible end closure secured to at least one of the opposed ends of the container that is free to move in-

wardly against food products contained therein when a vacuum is applied so as to provide cushioning support to the food products. As such, the food products are supported by a "pillow-like" cushion instead of a spaced metal end closure or other rigid surface as provided by current containers, thus preventing damage to the food products during transportation or inadvertent movement before the container is opened.

[0010] In particular, the container for vacuum packaging fragile food products, such as potato crisps, cookie biscuits, or baked wafers, includes a tubular body wall having opposed ends and inner and outer surfaces. The tubular body is formed using conventional spiral winding techniques known in the art, such as described in U.S. Patent No. 4,158,425, which is assigned to the assignee of the present invention and herein incorporated by reference.

[0011] In one embodiment, a flexible liner that is impervious to the passage of liquids and gasses is also included. The flexible liner is secured to the respective ends of the tubular body by way of an adhesive band between the liner and the inner surface of the tubular body wall adjacent each end of the tubular body wall. As such, a free medial portion is defined between the opposed end portions of the liner that is free to move inwardly from the tubular body wall when vacuum is applied and then to move outwardly toward the inner surface of the tubular body wall when the container is opened and vacuum is lost. Although not necessary to practice the invention, the liner preferably comprises a flexible and stretchable liner formed of at least one polymeric layer without foil and paper layers. Other types of liner materials may also be used, such as liners comprising polymer/foil, kraft paper/foil/polymer, or kraft paper/foil laminates. Accordingly, the liner can move inwardly to substantially form to the contours of the food products contained therein, thus providing not only a hermetic seal but also cushioning support to the food products. In this manner, the vacuum created during packaging does not act directly on the body wall thus preventing inadvertent collapse of the body wall. When the container is opened, the vacuum is lost and the liner moves away from the food products such that the products may be removed. A label surrounds the outer surface of the body wall.

[0012] A vent hole can be formed through the body wall and the label, such as with a laser, for allowing the passage of air therethrough. The vent allows the medial portion of the liner to move inwardly against the food products and allows air to enter the cavity formed between the liner and the tubular body when vacuum is applied.

[0013] Advantageously, a flexible end closure is secured to at least one of the opposed ends of the tubular body. The flexible end closure moves inwardly against the food products contained within the tubular body when vacuum is applied so as to provide cushioning support to the food product. The flexible end closure includes a foil layer that is impervious to the passage of liquids and gasses, and in one embodiment, two flexible end closures are included for providing even further cushioning support to the food products.

[0014] Associated methods also form a part of the invention and, according to one embodiment, include the steps of forming a tubular body wall with opposed ends and a flexible liner adjacent the inner surface of the body wall, closing one end of the tubular body wall, and depositing the food products within the liner and tubular body wall. The vacuum packaging operation can then be performed by applying a negative pressure to the open end of the tubular body and then closing the open end of the tubular body with the flexible end closure. The negative pressure is then released such that the flexible liner is moved inwardly from the inner surface of the body wall against the food products, and the flexible end closure moves inwardly against the food products to provide cushioning support therefor.

[0015] Accordingly, and as is explained in more detail below, the Applicants have provided a new container for fragile food products which overcomes the disadvantages of conventional containers. The present invention is particularly advantageous for food products that are easily damaged during transportation, such as potato crisps or cookie biscuits. The new container is easy to open for consumers, and can use conventional body wall and label construction techniques, such as an overlapping or anaconda seam. At the same time, however, the present container is capable of withstanding the rigors of vacuum packaging so as to maintain a rigid shape and provide a hermetically sealed container to prevent air and moisture from contaminating the food products contained therein.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] While some of the objects and advantages of the present invention have been stated, others will appear as the description proceeds when taken in conjunction with the accompanying drawings, which are not necessarily drawn to scale, wherein:

FIG. 1 is a perspective view of a container of the present invention;

FIG. 2 is a greatly enlarged sectional view of the container of the present invention as seen along lines 2-2 of FIG. 1 shortly before the vacuum packaging operation;

FIG. 3 is a greatly enlarged sectional view of the container of the present invention as seen along lines 2-2 of FIG. 1 shortly after the vacuum packaging operation;

FIG. 4 is a greatly enlarged sectional view of the container of the present invention as seen along lines 2-2 of FIG. 1 shortly after the vacuum is lost;

FIG. 5 is a sectional view of the container having a liner ply according to the present invention;

FIG. 6 is a sectional view of a portion of the container seen in FIG. 5;
FIG. 7 is a greatly enlarged sectional view of a portion of the container seen in FIG. 5; and
FIG. 8 is a view of an embodiment of an apparatus for making a tubular container according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0017] The present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout.

[0018] Turning first to FIGS. 1-5, a tubular container **10** is illustrated and is particularly advantageous for vacuum packaging fragile food products **11**, such as potato crisps or cookie biscuits having multi-sided shapes. Other food products that may break during transportation or rough handling after packaging are crackers, wafers, and the like.

[0019] Although illustrated as having a circular cross section, the tube of the container **10** may have any cross sectional shape that can be formed by wrapping the tube around an appropriately shaped mandrel. One example is a generally rectangular shaped tube having rounded comers. As illustrated in more detail in FIGS. 2-4, the tubular container **10** includes a body wall comprising at least one body ply **13** that is preferably formed of a strip of paperboard. In one embodiment, the tubular container **10** also includes a liner ply **14** comprising a polymeric material and adhered to the inner surface of the body ply **13.** Other materials may also be included, such as kraft paper and/or foil. A label ply **16** is adhered to the outer surface of the body ply **13.** The label ply **16** is conventionally constructed from materials known in the art, such as kraft paper, polymers, or the like. In addition, a cap **19** may be secured to an end of the container **10.**

[0020] The body ply **13** may be advantageously composed of conventional spiral-winding paperboard having a thickness of about 0.15-0.30 inch, and preferably about 0.20 inch. Such a body ply **13** is described in U. S. Patent No. 5,988,493, which is assigned to the assignee of the present invention and is herein incorporated by reference.

[0021] The liner ply **14** is typically constructed of multiple layers. Preferably, one of the layers forms a barrier to moisture and/or gasses. It will be understood that various barrier materials and liner plies could be employed depending upon the item being packaged. However, in a preferred embodiment, the liner ply **14** is substantially entirely formed of polymeric material. In particular, liner plies such as described in U.S. Patent No. 5,829,669, which is assigned to the assignee of the present invention and is hereby incorporated by reference, may be used.

[0022] The barrier layer of the liner ply **14** is resistant to the passage of liquids and gasses such as oxygen. If a high barrier is required for both liquids and gasses, preferred barrier materials are metallized polyester or metallized polypropylene. It will be understood that various barrier materials could be employed depending upon the food products **11** being packaged. One surface of the barrier layer may include a thin metallized coating to provide a metallic appearance and also to enhance the barrier properties. The metallized coating, which may be formed of aluminum, is significantly thinner than a foil layer, however, and is not necessary for strength or barrier properties in certain applications. It is to be understood that the liner ply **14** is not required for some types of food products **11.** However, the liner ply **14** provides an added cushioning support when vacuum is applied that is desirable in most circumstances.

[0023] FIGS. 5-7 show sectional views of the tubular container **10** wherein the axially opposed end portions of the liner ply **14** are adhered to the inner surface of the body ply **13** by a pair of adhesive bands **15.** The adhesive bands **15** are separated such that a medial portion of the liner ply **14** between the axially opposed end portions remains free and unattached to the body ply **13.** Accordingly, after the food products **11** have been placed inside the cavity defined by the body ply **13,** the cavity is subjected to a vacuum and the unattached medial portion of the liner ply **14** will be withdrawn against the food products **11.**

[0024] Advantageously, the present invention also includes a flexible end closure **20** (sometimes referred to as a "membrane") that is affixed to an end of the tubular container **10.** The other end closure of the tubular container **10** may be constructed of steel or aluminum plate with applied coatings and/or electrolytic tinplate. The invention is not limited to one flexible end closure **20,** however, as two flexible end closures **20** may be affixed to respective ends of the tubular container **10.** The flexible end closure **20** is preferably made of a flexible laminate made of films, kraft paper, foil, and/or extruded polymers and is heat sealed or adhesively attached to the end of the tubular container **10.**

[0025] In particular, the flexible end closure **20** includes a barrier layer that serves as a barrier to the passage of liquids and/or gasses such as oxygen. If a barrier is required for both liquids and gasses, the barrier material is preferably selected from the group consisting of metal foil, such as aluminum foil, polyethylene terephthalate, modified polyethylene terephthalate, polyethylene napthalate, polyamide, metallized and silicate coated polyester, metallized and silicate coated polypropylene, metallized polyamide, polyvinylidiene chloride, ethylene vinyl alcohol, and mixtures thereof. Other layers may be disposed on the outermost surface of the flexible

end closure **20** away from the inside of the tubular container **10,** including paper or paperboard layers, such as a kraft paper layer.

[0026] In one embodiment, the flexible end closure **20** further includes a seal layer **22** comprising a heat sealable composition and positioned such that the seal layer **22** of the flexible end closure **20** is adjacent the liner ply **14.** The seal layer **22** of the flexible end closure **20** is preferably constructed of a material selected from the group consisting of ethylene vinyl acetate, ionomeric polymers, such as SURLYN® polymer, high density polyethylene, low density polyethylene, ethylene methyl acrylate, metallocene catalyzed polyolefins and mixtures or blends thereof. The seal layer **22** of the flexible end closure **20** preferably has a melting point within the range of about 70°C and 130°C. More preferably, the melting point of the seal layer **22** is between about 80°C and 110°C.

[0027] A preferred construction of the seal layer is disclosed in U.S. Patent Application Serial No. 09/416,194, filed October 12, 1999, entitled "Sealant Layer for Container Lid." This application is assigned to the assignee of the present invention and is herein incorporated by reference.

[0028] An alternative end closure that can be used comprises a steel or aluminum flanged rim with applied coatings and/or electrolytic tinplate with a center panel of a flexible laminate made of films, foil, and/or extruded polymers and having a tab extending therefrom for grasping by the consumer. Such an end closure is sold under the trademark ULTRASEAL® from Sonoco Products Company.

[0029] U.S. Patent No. 4,158,425 discloses a composite container comprising a tubular body and an inner liner coextensive with the length of the tubular body and affixed by adhesive to the opposed ends thereof. Opposed end caps are hermetically sealed on the ends of the container such that a vacuum can be drawn internal to the inner liner. However, the end caps do not move inwardly toward the food products when vacuum is applied in order to provide cushioning support to the food products located therein. Thus, upon a vacuum being applied the liner is withdrawn against the food products, but the end closures remain rigid. Thus, this patent may not provide sufficient protection for fragile food products, such as potato crisps and cookie biscuits, that may be easily damaged during transportation. In particular, the end closures of the '425 patent may not absorb impacts from the food products packaged within the container caused during transportation, thus leading to broken food products, which is undesirable to consumers.

[0030] Advantageously, unlike the '425 patent, the present invention allows for the packaging of fragile food products **11,** and, in particular, the packaging of fragile food products under a vacuum. As discussed above, fragile food products such as potato crisps and cookie biscuits are particularly disposed to breakage during transportation, where rough handling and jostling occur that may cause the food products **11** to hit against the inside of the container **10.** With the present invention, the flexible end closure **20** readily accommodates the jostling of the food products **11** by moving inwardly against the food products when vacuum is applied, thus creating a pillow-like cushioning support to the food products and preventing accidental breakage of the food products. The position of the flexible end closure **20** when vacuum is applied is shown in FIGS. 5-7. In one advantageous embodiment shown in FIG. 5, two flexible end closures may be included at respective ends of the container **10** for providing further cushioning support to the food products **11.** However, the invention is not limited to two flexible end closures, as one flexible end closure may be used in conjunction with a metal end closure **23** that is secured to an opposite end of the container **10** (see FIG. 6).

[0031] The medial portion of the liner ply **14** also moves inwardly against the food products **11** when vacuum is applied, which further adds cushioning support to the food products. For example, where the food products **11** have a multi-sided shape, the liner ply **14** moves against the food products **11** such that the liner ply substantially conforms to the contours, i.e., the multi-sided shape, of the food products, thus preventing the food products from moving within the liner ply. Therefore, under vacuum the liner ply **14** substantially prevents the food products **11** from moving in a radial direction in relation to the container **10,** and the flexible end closure **20** substantially prevents the food products from moving in an axial direction in relation to the container. If jostling occurs before the vacuum is lost, such as by opening the container **10,** the flexible end closure **20** and the liner ply **14** absorb the impact forces of the food products **11** caused by the jostling such that the food products remain unbroken. The positions of the liner ply **14** and flexible end closure **20** while under vacuum can be seen in FIGS. 5-7.

[0032] The container **10** of the present invention may be manufactured by the process illustrated in FIG. 8. As shown, a continuous strip of paperboard body ply material **13** is supplied to the apparatus **48** and is first passed through a pair of opposed edge skivers **50.** The edge skivers remove part of the square edge of the body ply **13** to create first **52** and second **54** edges having a beveled configuration. The body ply **13** is then advanced through an adhesive applicator **56,** which applies an adhesive **21** to the upper surface of the body ply **13.** The adhesive **21** is advantageously an aqueous adhesive, which overcomes the many problems associated with solvent-based adhesives. No special equipment is needed to capture solvents that evaporate from the adhesive in order to comply with environmental regulations. Preferred adhesives are aqueous low glass transition temperature ethylene vinyl acetate (> 18 %) materials. One preferred adhesive is No. 72-4172, which is available from the National Starch and Chemical Company. Another adhesive that may be used is No.

33-4060, which is also available from the National Starch and Chemical Company. The adhesive **21**, as well as other adhesive layers used to construct the container **10**, may be applied in the form of a foam as described in copending U.S. Patent Application Serial No. 09/197,275 entitled, "Composite Container Having Foamed Adhesive," which is assigned to the assignee of the present invention and hereby incorporated by reference.

[0033] The body ply **13** and wet adhesive **21** applied thereto may then be passed underneath a heater **58** which evaporates at least part of the water content of the aqueous adhesive **21** to render the adhesive substantially tacky. It is important that the correct amount of heat is supplied to the adhesive. Insufficient heat will not evaporate enough water in a sufficiently short period of time with the result that the adhesive will not be rendered sufficiently tacky. Conversely, too much heat will overdry the adhesive and cause the adhesive to lose tackiness. A preferred type of heat source is an infrared heater although various other heat sources, e.g., forced air heating or the like can be used.

[0034] After heating the adhesive **21** on the body ply **13**, the body ply **13** and the liner ply **14** are fed to the shaping mandrel **70** from opposite directions. The body ply **13** is passed under skive adhesive applicator **60** which applies the skive adhesive **59** to the beveled surface of the skived second edge **54** of the body ply **13**. The skive adhesive **59** is preferably a hot melt adhesive of the type which is conventional in the art, although it could also be a water based adhesive including one or more polymers. Polyvinyl acetate and ethylene vinyl acetate are the preferred liquid adhesives. The skive adhesive **59** helps provide a stronger body ply bond especially for single body ply containers.

[0035] If the liner ply **14** is of a polymeric type material, the surface of the liner ply that contacts the body ply **13** may be subjected to a corona treatment station **62**. The opposite surface of liner ply **14** is coated with lubricant from a roller **64**, which allows the liner ply to slide smoothly during the winding operation. The liner ply **14** is then passed through an edge folder **65**, which folds over the first marginal edge portion **41** to create an anaconda fold in the liner ply, and adjacent to an infrared heater **66**, which heats the second marginal edge portion **42** of the liner ply. After the infrared heater **66**, the second marginal edge portion **42** of the liner ply **14** is then passed adjacent to at least one forced air heater **68**.

[0036] The body ply **13** and the liner ply **14** are then wrapped around the shaping mandrel **70** from opposite sides of the mandrel. Each ply is first wrapped under the mandrel **70** and then back over the top in a helical fashion with the liner ply **14** wound against the surface of the mandrel. The first marginal edge portion **41** of the liner ply **14** is exposed on the mandrel **70** and is subjected to heat from a second forced air heater **72**.

[0037] As the body ply **13** is further wrapped and the first edge **52** of the body ply **13** advances back under the mandrel **70** after one complete revolution, it is brought into contact with the second edge **54** of the ensuing portion of the body ply **13** which is first coming into contact with the mandrel. The skived edges **52, 54** become overlapped and the skive adhesive **59** adheres the edges together to form a spirally wound tube which advances along the mandrel **70**.

[0038] With regard to the liner ply **14**, the first marginal edge portion **41** is brought into an overlapping relationship with the second marginal edge portion **42** to create a sealed anaconda seam. The seal is formed by polymeric seal layers of the first and second marginal edges **41, 42** becoming bonded to each other. However, a strip of hot melt adhesive or other adhesives and methods could alternatively be used for securing and sealing the liner overlap.

[0039] The tube is then advanced down the mandrel **70** by a conventional winding belt **74**, which extends around a pair of opposed pulleys **76**. The winding belt **74** not only rotates and advances the tube, but also applies pressure to the overlapping edges of the body ply **13** and liner ply **14** to ensure a secure bond between the respective ply edges.

[0040] An outer label ply **16** is then preferably passed over an adhesive applicator **78** and wrapped around the body ply **13**. The label ply **16** could be applied before the winding belt **74**. At a cutting station **80**, the continuous tube is cut into discrete lengths and removed from the mandrel **70**. The cut is positioned to divide the adhesive strips created by the applicator **56** so as to create the adhesive bands **15** for the opposite ends of successive containers.

[0041] A rapid application of vacuum could cause problems with the body ply **13**. In particular, the volumetric decrease of the liner ply **14** creates a negative pressure in the cavity between the exterior surface of the liner ply **14** and the inner surface of the body ply **13**. This creates a pressure differential across the body ply **13** that could cause a collapse of the body ply **13**. Advantageously, a vent hole **17** is provided through the body ply **13** and the label ply **16** of the present invention to allow air to fill the cavity between the exterior surface of the liner ply **14** and the inner surface of the body ply **13**. The vent hole **17** thus alleviates the pressure differential on the body ply **13** and prevents collapse of the body ply. The vent hole **17** can be formed at the cutting station **80** with a laser device **82** which is intermittently pulsed to burn a hole through the label ply **16** and body ply **13** for each container length. Other venting arrangements are also possible, such as by a slot or a series of dots cut through the label ply **16** and the body ply **13**.

[0042] The end closures are then attached to the ends of the tubular body ply **13**. At least one of the ends of the container **10** is rolled outwardly to form a rim **18** which provides a suitable surface for affixing the flexible end closure **20**. Another end closure, such as a metal closure or a flexible end closure as described above, is

attached to the other end of the container **10**. Typically, the metal end closure is applied to one end of the container **10** prior to filling of the container with the food products **11**. A preferred metal end closure is disclosed in U.S. Patent No. 5,971,259, which is assigned to the assignee of the present invention and herein incorporated by reference. The metal end closure can be provided with a sealing compound to effect a hermetic seal if desired. Alternatively, two flexible end closures **20** may be affixed to the container **10** by rolling the ends of the container outwardly to form rims on both ends of the tubular body ply **13**.

[0043] After filling with the food products **11**, a vacuum is applied to the open end of the container **10** that removes at least a part of the air remaining within the cavity defined by the liner ply **14** and the attached end closure. Before the vacuum is released, another end closure is applied to the opposing end of the tubular body. The vacuum is then released, causing the flexible end closure **20** to move inwardly towards the food products **11**, thus providing the pillow-like cushioning support as described above. In one embodiment, the vacuum applied is less than 30 inches of Hg. Preferably, the vacuum applied is about 8-15 inches of Hg, and more particularly about 12-15 inches of Hg. On the other hand, the type of container described in U.S. Patent No. 4,158,425 typically includes a vacuum of 30 inches of Hg or more. The type of container described in the '425 patent is designed for less fragile products, such as ground coffee or hot filled juice. Advantageously, the present invention allows for lower amounts of vacuum than the '425 patent, which is particularly important for fragile food products **11**. More specifically, high amounts of vacuum may cause the liner ply **14** to crush the fragile food products **11** contained therein, and may further cause the flexible end closure **20** to overflex inwardly and break the seal between the flexible end closure and the body ply **13**.

[0044] When the container **10** is opened by the consumer, the vacuum maintained inside the liner ply **13** and flexible end closure **20** is lost, causing the liner ply to withdraw somewhat from the food products **11**. This withdrawal of the liner ply **14** frees the food products **11** from being trapped by the liner ply and helps in removal of the food products from the container **10**. The flexible end closure **20** is then typically fully removed by the consumer and thrown away. If more than one flexible end closure is used, the remaining end closure returns to a generally flat shape substantially perpendicular to the length of the container **10**. The food products **11** can then be removed by the consumer.

[0045] Many modifications and other embodiments of the invention will come to mind to one skilled in the art to which this invention pertains having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the invention is not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. For example, the tubular containers according to the present invention are not necessarily helically wound but may instead be longitudinally wrapped to create a "convolute" tube having an axially extending seam. In addition, although the tubular containers according to the present invention have been described primarily in connection with fragile food products, it is to be understood that the containers could be used in connection with other products where a flexible end closure is advantageous, including products other than food which may be fragile (such as wine glasses or Christmas tree ornaments) or otherwise benefit from being stabilized within a container. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

Claims

1. A container (1) for vacuum packaging products (11) of a type that may be damaged during transportation, said container comprising:

   a tubular body wall (13) having opposed ends and inner and outer surfaces and comprising a wound strip of material;
   a flexible liner (14) having opposed end portions secured to respective ends of the tubular body wall and a free medial portion between the opposed end portions of the liner, said medial portion of said flexible liner being free to move inwardly against the product when vacuum is applied so as to provide cushioning support to the product; and
   a flexible end closure (20) secured to at least one of the opposed ends of said tubular body wall, said flexible end closure being free to move inwardly against the product when vacuum is applied so as to provide cushioning support to the product.

2. A container according to Claim 1, further comprising an adhesive band (15) between the liner and the inner surface of the tubular body wall adjacent each end of the tubular body wall for securing the opposed end portions of the liner to the tubular body wall.

3. A container according to Claim 1, wherein two flexible end closures are secured to the opposed ends of the tubular body wall.

4. A container according to Claim 1, wherein the tubular body wall defines a vent (17) for allowing air to enter the cavity between the flexible liner and the inner surface of the tubular body wall.

5. A container according to Claim 1, wherein said liner comprises a flexible and stretchable liner of at least one polymeric layer without foil and paper layers.

6. A method of vacuum packaging a product (11) of a type that may be damaged during transportation, said method comprising the steps of:

providing a tubular body wall (13) with opposed ends and a flexible liner (14) adjacent an inner surface of the body wall;
closing one end of the tubular body wall;
depositing the product within the liner and tubular body wall;
closing the open end of the tubular body wall with a flexible end closure (20); and
creating a negative pressure within the tubular body wall such that said flexible liner and said flexible end closure are freely moved inwardly against the product and provide cushioning support of the product.

7. A method according to Claim 6, further comprising the step of allowing the passage of air through a vent (17) in the tubular body wall during the negative pressure creating step.

8. A method according to Claim 6, wherein said negative pressure creating step creates a negative pressure inside the flexible liner such that both end closures are freely moved inwardly against the product so as to provide cushioning support of the product.

9. A method according to Claim 6, wherein said step of depositing the product further comprises depositing a product having a multi-sided shape and wherein said step of creating a negative pressure inside the flexible liner causes the flexible liner to be moved inwardly and substantially form to the contours of the product.

10. A method according to Claim 6, further comprising the step of opening the container by removing the flexible end closure from one end of the tubular body wall.

11. A method according to Claim 10, wherein said opening step further comprises causing the flexible liner to partially withdraw from the product so that the product can then be removed from one of the opposed ends of the tubular body.

FIG. 1.

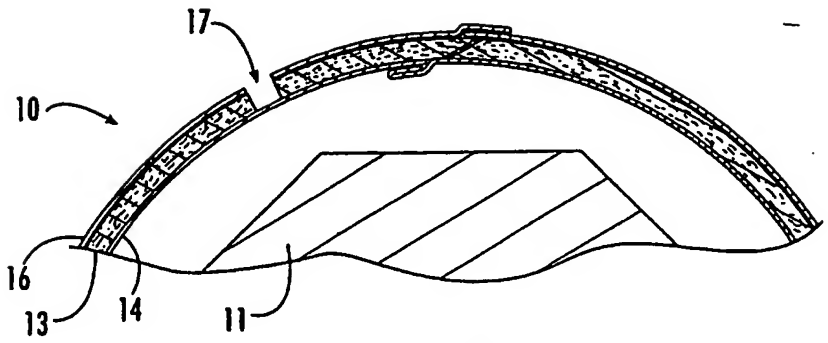

FIG. 2.

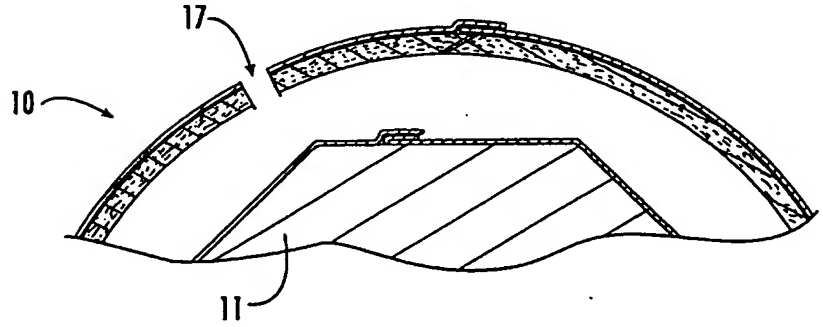

FIG. 3.

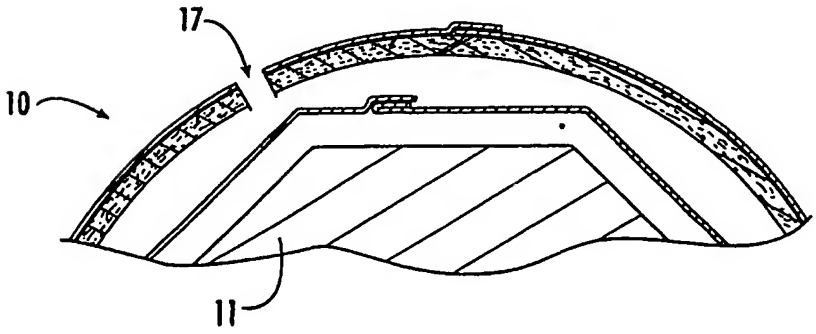

FIG. 4.

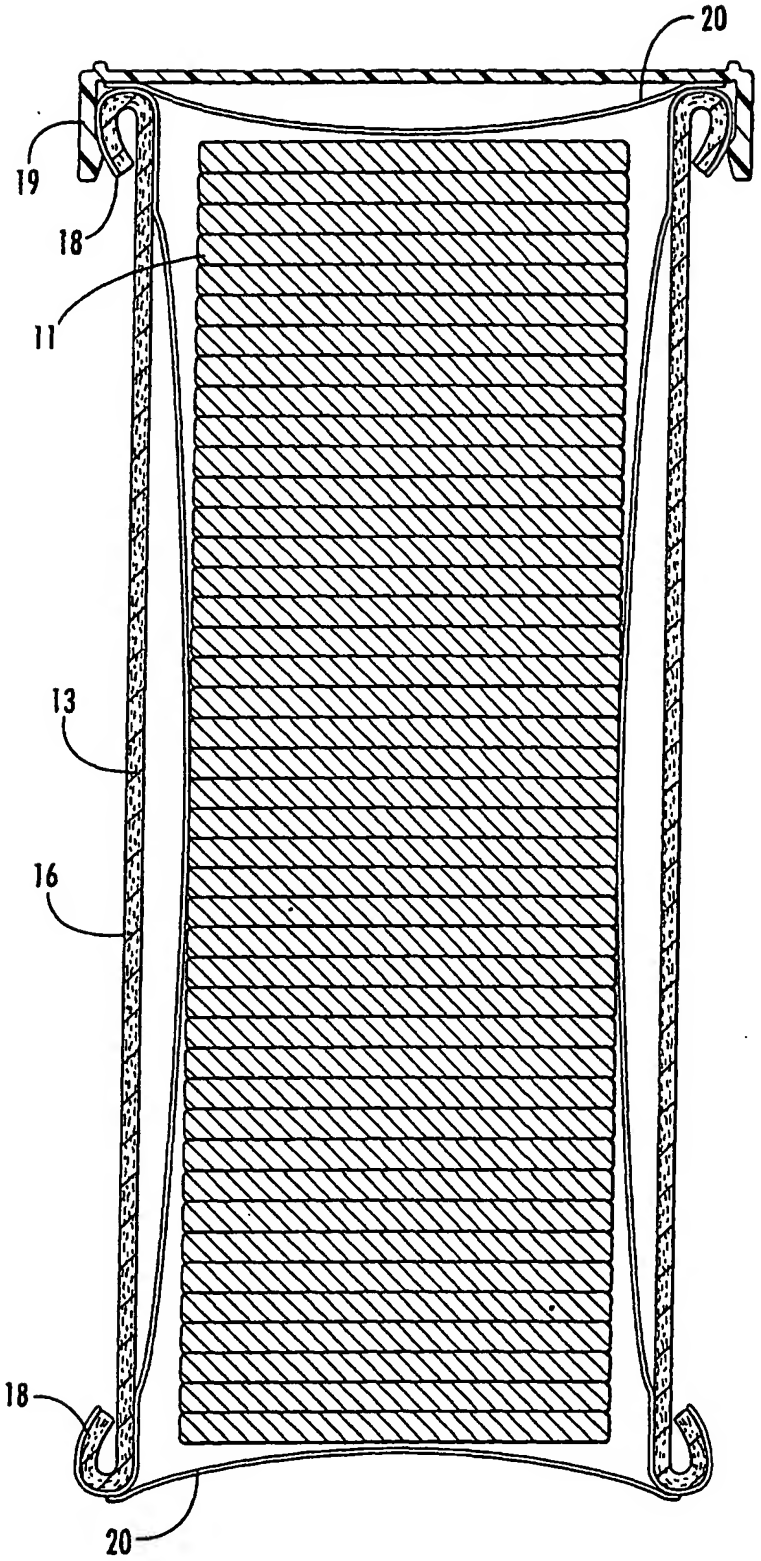

FIG. 5.

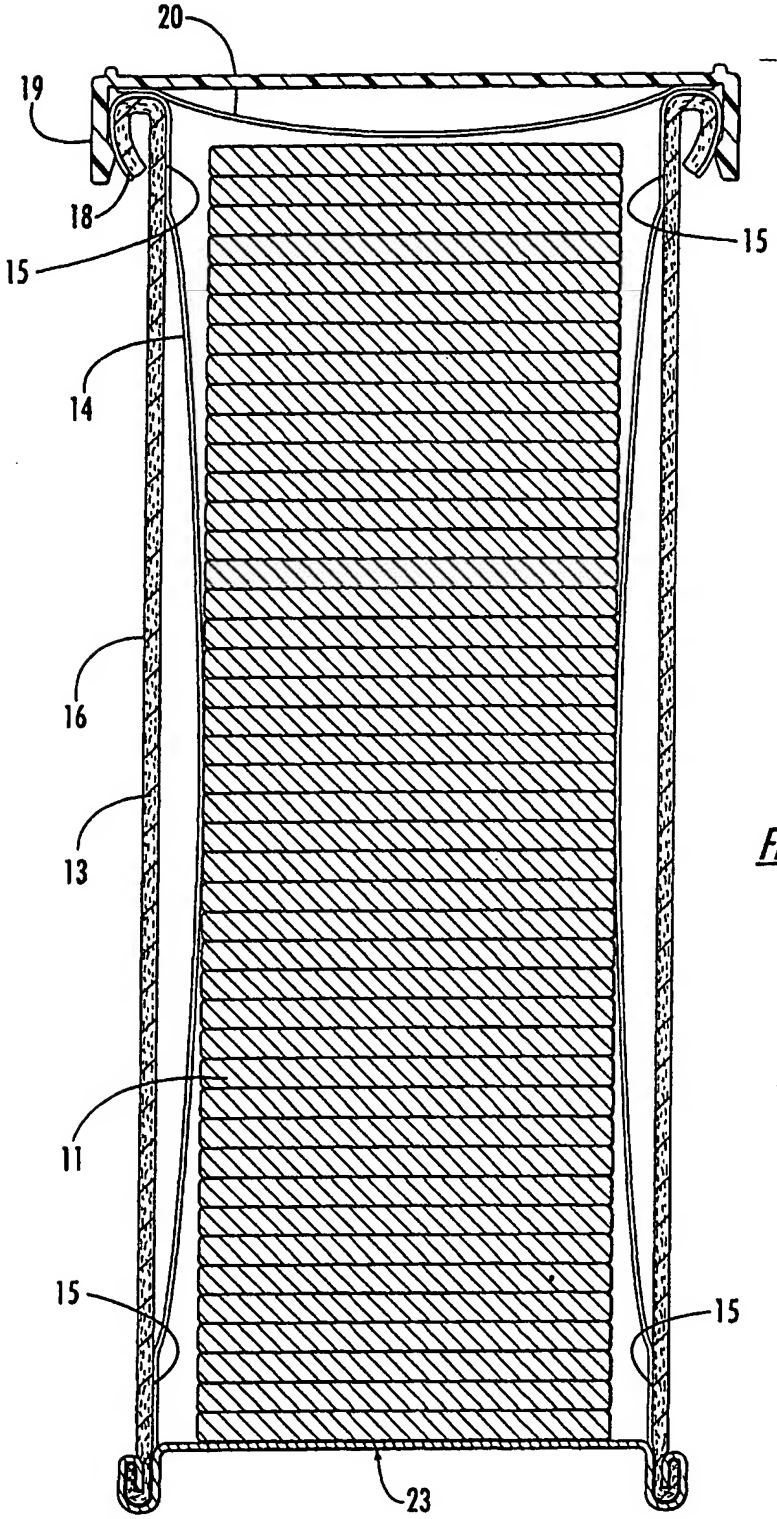

FIG. 6.

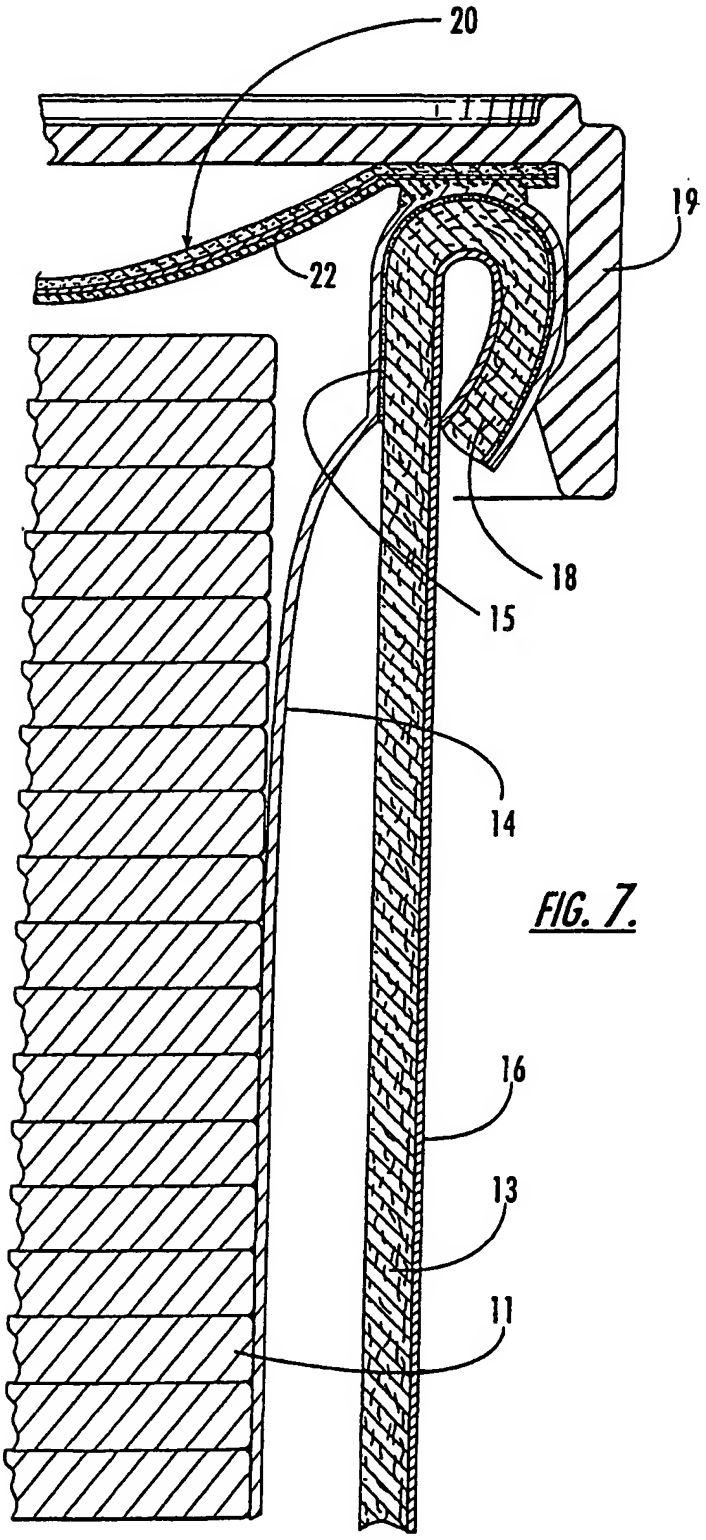

FIG. 7.

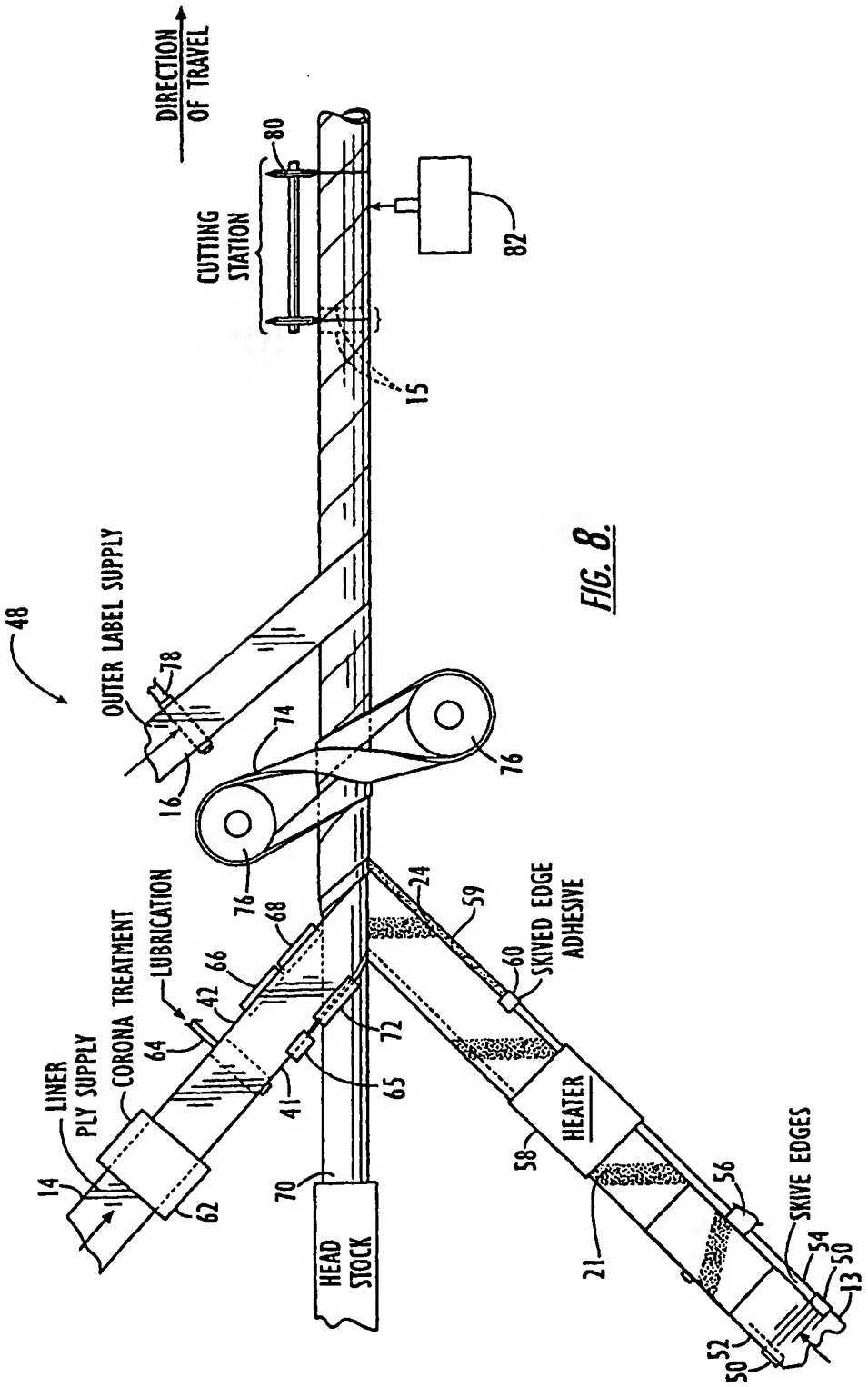
DIRECTION OF TRAVEL
CUTTING STATION
80
82
15
48
OUTER LABEL SUPPLY
78
16
74
76
76
68
66
42
64
LUBRICATION
CORONA TREATMENT
LINER PLY SUPPLY
14
62
41
65
72
24
59
60
SKIVED EDGE ADHESIVE
HEATER
58
70
HEAD STOCK
21
56
SKIVE EDGES
54
50
13
52
50

FIG. 8.